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Suite 400 - 11010 - 142 Street, Edmonton 50, Alberta

INSTRUCTIONAL RESOURCES

by

JOHN FRITZ

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Edmonton, AB
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The purposes of these papers are to bring to the attention of the Commission informed points of view regarding a series of issues, to suggest basic concepts of principles to guide planning and development at all levels of education in the years to come, and to project contemporary thought into the future.

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PART I

INTRODUCTION

The examination of instructional resources and their applicability to formal and informal processes of schooling has been pursued with the expectation that the Commission's concern is with the emerging problems facing agencies which are responsible for serving the educational needs of citizens in this province in the decades ahead. While there may be some risk in moving prematurely with such an orientation, it is more likely that the treatment of the topic will deal with developments of greater relevance and promise pertaining to the uses of various instructional resources in education. The basic concern guiding the discussion is the question: What potentialities for extending and improving instruction and, therefore, education reside within the repertoire of available communications media, electronic devices, and evolving instructional systems, potentialities that can be realized through administratively feasible and economically defensible approaches to their enlistment? The aim is to examine this potentiality as revealed by research into media effectiveness, recent theoretical formulations, developmental projects involving various devices and instituted at various levels of education and the informed speculations and projections of knowledgeable practitioners and leaders in the field.

Some Preliminary Observations

(1) Within the next few decades this province will face two pressing educational challenges: (a) the need to engage ever larger

proportions of the population in a sustained effort to pursue life-long learning and growth; (b) the need to enlarge considerably access to adequate educational opportunity for all sectors of the population at a level of financial outlay that does not threaten to overburden obtainable resources. It is further assumed that most efforts at continued learning will be facilitated through some institutional or organizational avenue of a rather formal nature, including schools, colleges, universities and other post-secondary institutions. This assumption should not exclude efforts to explore other arrangements in facilitating the continued development and growth of individuals, particularly those involving correspondence and other extra-institutional means for facilitating learning. It is merely expected that much of the "crunch" in continuing to provide effective learning opportunities will occur in the form of stresses experienced by existing institutional agencies as delivery systems in education.

(2) It is also not premature to insist that we juxtapose derived benefits against the costs of existing and future practices in education. This concern for the costs of instruction when examined against the products realized will become an increasingly sensitive political issue as well as a growing economic problem. Whether future adaptations of instructional technology can provide some hope or relief in this area will depend greatly upon the capabilities of existing institutions to institute requisite changes within prevailing structures and procedures.

(3) As solutions are attempted in efforts to resolve emerging educational problems, we need to assure that, at the minimum, the quality of education is not diminished as we extend enlarged educational

opportunities to wider sectors of the population. While it may not be enough to approximate current levels of achievement and competence as outcomes of contemporary schooling, such approximation would still be commendable in itself if equivalent achievement were realized among larger proportions of the population at economically defensible levels of expenditure.

(4) It is recognized that such an aim may be somewhat difficult to realize as wider opportunities are made available to more people for their own continued development. This commitment will present the government and the schools with unusual demands as they cater to learners with stubborn intellectual, emotional, or cultural deficiencies.

Recent Trends Having Relevance for Instructional Resources

In a recent address to school administrators, Andrews[1] identified one significant trend in Canadian education as that of increased universality which continues relentlessly in this country as well as in other Western nations. Larger percentages of high school students continue to graduate and a constantly growing number of graduates elect to pursue education in some post-secondary institution. The rapid growth of adult education threatens to place additional burdens upon existing educational institutions. A comparable extension of education will occur downward into the early pre-school years with the wider adoption of kindergarten and other pre-school programs.

A second trend mentioned by Andrews is that of the increasing diversity and complexity of program offerings, particularly in the high school and post-secondary educational organizations. A related development

is that of programs attempting to differentiate learning experiences in keeping with the acknowledged differences in learner characteristics. Such efforts at differentiation and learner accommodation will place new pressures upon existing school curricula, organizations, facilities, and staff.

Both of these trends pose considerable problems to school authorities, problems which may well yield to the effective adaptation of available instructional media and technology. The extent to which such a prospect is truly indicated will be assessed within the remainder of this paper.

PART II

THE STATE OF THE ART

Terminology

While the title of this paper, as assigned, is "Instructional Resources", this area has undergone significant re-classification during the past decade. For our purposes, it is suggested that instructional resources may be seen in terms of two designations:

(1) Those media and devices, both print and audiovisual, such as textbooks, motion pictures, filmstrips and slides, tape and disc recordings, overhead transparency projectiles, television, and realia, models, specimen, exhibits and dioramas, have generally been viewed as "aids" serving the teaching purposes of the teacher.

(2) A second designation typically employs the term technology, such as educational or instructional technology, and refers to a way of thinking about that repertoire of communications media and devices in

terms of their place within a comprehensively conceived and designed instructional system. Included in this "system" is a definitive concern for the joining of human and mechanical or electronic components in a working configuration. The design of such a system focuses strongly upon educational purposes to be achieved and the flow of information as deliberately managed and controlled in the service of desirable learning outcomes.

In the main, present research and developmental efforts can be categorized in one or the other classification type. Earlier studies focused upon a particular medium and attempted to bring about improved learning through its calculated use in a given classroom situation which, otherwise retained its traditional characteristics. More recent efforts are directed at the way in which particular communications media and devices uniquely affect the characteristics of stimuli comprising the message or information in single or multiple distribution channels. In addition, growing attention is directed at evolving more effective instructional systems within educational organizations.

It is noteworthy to point out that the first designation implies typically a "supplementary role" for the communications media or device and tends to lock the functions of that device in the teaching act as conceived and managed by the live teacher. A different role has emerged in the second classification, better termed "complementary", in that increasing usage is made of the range of devices by the learner in an autonomous manner. Increasingly, self-instruction became the emphasis in experiments conceptualized around the second categorization. Hence the strong focus upon learning and the facilitation thereof in experiments

that fall in this latter category of applications.*

Efforts to Document Media Effectiveness

(a) Picture versus word studies

It would be appropriate to provide a quick overview of what it is that we can confidently say about the effectiveness of various media applications in education. One type of research study continues to compare pictorial and verbal representations of meaningful and non-sense stimuli and to measure the learning of simple associations at a rather elementary level. Underlying these studies has been the quest to test an expression, often quoted, that "a picture is worth a thousand words". While there is considerable sympathy with the proposition that youngsters, in the course of their development, ought to encounter "meaningful learning experiences" these picture-word comparisons have not confirmed the belief in such a claim even though it is subject to frequent iteration. Studies by Lumsdaine,[2] Bern,[3] and Bourisseau, Davis, and Yamamoto[4] have failed to legitimize the confident uses of pictorial stimuli as more effective mediators of learning, though there is some suggestion as to their viability in facilitating certain types of learning. Nevertheless the early explications of Edgar Dale[5] continue to influence the pedagogical speculations of audiovisual practitioners who can always point to some classic historic references that help substantiate the "meaningful learning experience" approach to audiovisual

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*The evolution of the second category and the "systems approach" to the design of instructional procedures and the application of media was fostered considerably by the development of programmed instruction and the use of programmed material which incorporates significant features designed to facilitate self-learning.

media.[6, 7, 8] More recent conceptual, if not empirical, support has been drawn from work in cognitive development.[9, 10] Perhaps the most that can be said is that each of the audiovisual media possesses characteristics that may be important in specific instances of learning, but none would appear to be universally crucial. Where and how particular medium features are employed in a deliberate way to produce a specific learning outcome will still have to be ascertained by the intuitive judgment of experienced practitioners in communication.

Yet, enthusiasm continues to run high in the personal knowledge that these media have enormous potential for generating confrontation, fascination, and even excitement in the learner. Indeed, few would challenge this personal conviction who have "witnessed" the suspenseful landing on the moon with a "you are there" quality via the live TV transmission of the first human step on the moon's surface. Few would argue that seeing Henry V in a color motion picture does not yield a pronounced, though intangible impact on the viewer's feeling for Shakespearean drama. Even Morrison,[11] a science educator, is moved to insist that "the extension of perceptions by instrumentation provides a mixture of the aesthetic and the analytic," much as Vandenberg[12] claims that there is a need for the learner to experience the "landscape" as well as master the "geography". Though hard evidence continues to elude the committed, confidence is still manifest in the inherent capabilities of the communications media to enhance clarity, magnify understandings and intensify wonder and appreciation.

(b) Medium versus "live" instruction studies

Numerous studies have attempted to establish the superiority of one medium over traditional, typically "live", forms of instruction. These studies have used motion pictures,[13, 14, 15, 16] filmstrips,[17, 18] overhead transparencies,[19] tape recordings,[20] language laboratories,[21] and television.[22, 23, 24,*] In most of these studies, the newer media approximated traditional methods as to measured learning outcomes and, in some cases, produced superior results. With the advent of programmed instruction as a technique for structuring the learning process, an increasing array of programmed material was subjected to similar scrutiny and evaluation in test situations by comparing selected sequences of programs to, again, traditional instructional procedures.[26, 27, 28, 29, 30] Comparable results were obtained in this series of investigations with the notable feature that varied time periods were required by learners to complete the programmed material.

If nothing else, the frequent N.S.D. (no significant difference) results of these studies support the conviction that these media can teach. Whatever the contrivance or device, the likelihood is strong that a given period of instruction with it will produce results comparable to those generally attained through conventional means of schooling. However, a variety of factors can be identified as contributing to these somewhat inconclusive results, not the least of which is a typical absence of definitive and precise articulation of expected learning outcomes, a

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*In a recent series of experiments employing television throughout a number of schools in Alberta, the Department of Education obtained significantly better results through the use of a videotaped series of television presentations by a reading specialist in cultivating improved reading competence among high school students.[25]

sufficient supply of relevant media programs of acceptable quality, and the use of evaluation procedures which rely heavily upon verbal learning.

Two important implications can be drawn from this accumulated evidence: (1) future introductions of instructional media and related technology should allow for the operational factors that affect the ways in which teacher and learner engage themselves; (2) more promising approaches to the application of instructional resources will require not the "additive" tactic implicit in the supplementary concept of media role and clearly evident in the experimental procedures in the studies cited above but a more thorough and simultaneous rearrangement of other key constituents, facilities, and agents in the total instructional process.

Hence, an increasing interest is evidenced in more recent research efforts in the "operations research" strategy[22, 23] which directs attention to factors, typically ignored in traditional research design, such as sources of resistance to the full play of instructional technology within the learning situation, cost items, varying arrangements of equipment, and concomitant effects upon learner and instructor other than those involving the desired learnings. It was VanderMeer[14] who, in 1950, produced evidence that one of his instructional modes involving the exclusive use of motion pictures in a general science course led to a 20% saving of instructional time. Since the time of his study, Hughes[31] found that students using programmed texts scored not only 10% higher than the conventional class on an achievement test but that instructional time was reduced 27%. Through the systematic and extensive use of overhead transparencies, Chance[32] saved 15 minutes in each 60-minute

period in an engineering descriptive geometry course.* In a two-year study conducted by the author with a number of high school physics teachers and classes, four instructional components or dimensions were manipulated simultaneously in an effort to create maximum impact in an experimental learning climate.[33] By exploiting the complementary role of communications devices and combining media with team teaching and a redefinition of task engagements of the live teachers, it was discovered that each teacher engaged in the experimental system had made available to him an average of over one hour per day free time as an outgrowth of the operation of the new instructional procedures. Student learning, as measured by a series of achievement tests, showed no loss of achievement. Indeed, the pattern of results appeared to favour the students who were taught by the total experimental system.

A critical examination of these studies attempting to establish the effectiveness of instructional media led the author to conclude that for some kinds of instruction, particularly those teaching tasks that are largely expository in nature and can take the form of lecture-demonstration presentations, communication devices, other than the live teacher, such as the motion picture or television, could be expected to perform as effectively as present human means of instruction. Indeed, with detailed and careful preparation it may even occur that some forms of presentation

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*A personal example of the efficacy of overhead transparencies in affecting the rate of instruction was relayed to the author by Dr. D. Black, who is now at the University of Calgary, when he related that during a year of teaching experience when he had used a considerable number of transparencies in a statistics class, he found that he had "covered" the course at least four weeks before the end of the term. Anyone who is exceedingly conscious about the motions and operations involved in the typical use of chalkboard representation becomes acutely aware of the needless and expensive use of formal classroom time.

may well prove to be superior in quality by virtue of the exploitation of unique communication strengths that are inherent in particular media. However, it is fairly clear that schools cannot invoke the machine into their operations without disturbing the prevailing stability of tasks performed. Once the machine gains entree into a particular set of institutional processes, it necessarily exacts its due, typically in the form of often unexpected effects upon other agents and procedures that represent concomitant constituents in the existing array of activities.[34]*

Learning and Instructional Systems

Two recent publications[35, 36] have contributed significantly to the development of a conceptual model for integrating instructional media and related devices into the processes and conditions of learning. With a heavy commitment to principles of communication, Gagne suggests that the effective application of media will occur only when a suitable "match" is effected between select instructional mediators and clearly designated learning purposes in order to assure that the necessary communication functions will be performed in the course of learning activity. Hence he insists that the following conditions be observed:

(1) The identification of the capabilities which are to be learned by the learner -- a verbal chain, a motor chain, a concept, a principle, or a strategy -- must be ascertained;

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*Other factors operating to affect the measured outcomes in media taught classes may be what the author calls "compensatory effort" of students who may well have continued to function in terms of their own sensed deficiencies in the felt mastery of the subject matter of the course, the failure of the new procedures to change the perceptions of the learner in relation to the subject matter, and the availability of other sources of information which may have served to mask or obliterate the contribution of the experimental device.

(2) the requirements that each type of learning imposes upon the process of communication are to be described;

(3) the particular function in the flow of information which should be performed by a mediating device within the process must be clearly identified; and

(4) an instructional sequence incorporating these communication functions can then be designed, with proper selection of the medium or media best suited to perform each of these functions.

Gagne suggests further that if a choice of a single medium is to be made or a combination of media is indicated, this can be accomplished by selecting that device which can serve as a vehicle for the various communication functions without having other undesirable effects on the instruction to be undertaken. He shares the thinking of an increasing number of researchers in this area when he observes,

> The most general statement of the point of view presented here is that selection of media for instruction is a matter which has no single rationale, and can expect to have none, insofar as a match between medium and subject matter is concerned, or for that matter, between medium and individual ability of the student. The basis of such matching needs to be sought in elaboration and empirical setting of classes of communication functions, several or all of which are involved in every unitary instructional sequence, regardless of subject matter. On the basis of an analysis of such functions, decisions can be made regarding the medium or combination of media most likely to accomplish the total purpose of instruction.[37]

In a determined effort to make provision for essential developmental procedures as well as the psychological or pedagogical concerns in designing learning or instructional systems, Barson[38] undertook an investigation which involved four universities in the designing and testing of instructional systems development procedures. His approach emphasizes the necessity for identifying and involving the necessary specialists --

instructor, instructional specialist, evaluation specialist, and media specialist -- and planning for and implementing a sequence of steps or operations that include the following components:

(1) The specification of entry and terminal behaviors relevant to a course of instruction,

(2) the selection of instructional modalities and man-machine mediated operations and activities,

(3) the use of pre- and post-tests or examinations,

(4) the field testing of particular components as well as the total instructional system on a sample of student learners, and

(5) the refinement of the components and, eventually, the improvement of the overall systems design followed again with an evaluation effort that leads to further refinement as is seen necessary to achieve the learning objectives in the course.

Not only are the essential tasks or steps identified in this process of development, but, of equal importance, specific provision is made for the collaborative participation of the necessary specialists in the subject matter field, instructional design, evaluation, and in media deployment. In this developmental approach factors other than merely media applicability and effectiveness are considered -- attitudes of instructors to systems components and to the whole system, economic feasibility, administrative adaptability and the like. There is little practical value in proposing an innovative instructional technique which is prohibitive in terms of available economic resources. It is an equally futile exercise to proceed with an instructional plan that merely serves to threaten and arouse the apprehension of teaching staff. Nevertheless, the most encouraging outcome of such a developmental approach is the

strong inducement provided instructional staff to focus sharply upon the need for more specific and definitive statements of their learning objectives in a given course of study. The necessity to effect such definition forces many a teacher "back to the drawing boards".

Exemplar Systems Having Particular Significance

(a) in the schools

The two examples selected for illustration are presently undergoing extensive testing in schools in America and incorporate those essential features which are calculated to produce more viable instructional packages. The identification of behavioral objectives, the systematic sequencing of learning tasks to be performed, the intermittent assessment of learners through diagnostic and terminal tests, and the collection of information reflecting upon the adequacy of the entire system -- all have been provided for within the cases cited below. In addition, their introduction into particular schools and school programs is preceded by an intensive orientation of teachers, para-professionals, and administrators to the essential ingredients and requirements of the overall systems design.

Individually Prescribed Instruction (IPI) is a comprehensive instructional system that facilitates self-pacing of the learner throughout learning tasks in mathematics, covering, at this time, the first six grades of the curriculum. The significant feature in the IPI package is the important part played by intermittent prescriptions of learning tasks based on test information provided the teacher or the learner directly. The testing program includes an entry or placement test, a diagnostic test based upon a given unit of material, and a

proficiency test on the entire unit collating a number of educational objectives. In addition to the largely verbal program in paper form, the system can draw upon other media such as cassette tapes, filmstrips, and supplementary programmed material to provide varied alternatives for meeting unique learner needs. Bolvin,[39] one of the developers, reported recently that the instructional management of this program is of such a nature as to require the use of non-professional aides. Furthermore, the entire school organization in the building faces the need to accommodate the program by changing the typical grading system in that the individual pacing of learners is incompatible with a grade structure and a fixed curriculum typically characterizing traditional instructional programs. Most important, the re-engagement of the teacher accents diagnostic, planning, management, and evaluation responsibilities.*

Project PLAN is a comparable system that contains four essential components: a comprehensive set of educational objectives which are stated at a level of specificity that typically requires about two hours of student study to achieve; a teaching-learning unit which guides the student in the best way to achieve the objectives so specified; a set of tests for pre- and post-evaluation; and a comprehensive set of procedures to help guide individual planning for each student (the system uses an

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*Individually Prescribed Instruction is now reported to be the largest individualized learning project in the United States, serving 30,000 students in 164 schools and will expand to serve 75,000 students in 264 schools next fall.[40] There are three schools engaged in a pilot project in Alberta under support from the Human Resources Research Council. This project involves the field testing of the mathematics program in the first six grades in three schools located in Edmonton, Calgary, and Millarsville. Dr. H. Hallworth, of the University of Calgary, is exploring ways of linking the computer to this program, particularly for diagnostic and evaluative purposes.

IBM 360 model 50 computer which is located in Idaho and is connected to each of the participating school buildings with lines and remote input-output terminals). The computer is programmed to score tests, monitor the progress of each student, provide information about the experience and progress of the learner and maintain cumulative records of their results to be used in guidance and planning procedures as well as in the refinement of the total system.

A number of telling impressions are gained on visiting the schools and classrooms employing either one of the above systems. There is a pronounced work-oriented character in the behavior of the youngsters. They appear to be moving ahead at a steady pace without much hindrance or delay. Further, their activities appear to be highly varied, even within a group of 25 or 30 youngsters in a class. There is also marked evidence of instructional resources and materials which are directly employed. The youngsters are working on something, usually on their own, in the pursuit of fairly specific learning tasks. The classroom teachers are observed to be engaged in varied undertakings, at times appearing harried, as they attempt to respond to the diversity of demands placed upon them by the work and progress of individual learners. The need for teacher aides is strongly indicated in order to enable the classroom teacher to perform those necessary professional duties involving evaluation, individual tutoring, or instructing in small group remedial or seminar discussion settings.

It is fairly evident that any new instructional system, calculated to emancipate the individual learner into a more self-directed and autonomous entity, will have to invoke the sustained and direct use of those instructional media or resources that have capability in mediating

such autonomous learning. Print and audiovisual media can be expected to have prominent play in such systems. Without their direct and sustained application, it is unlikely that improved education for individual learners will be advanced to any significant degree. It is of some relevance to observe, as the author has reported in a recent article,[41] that the flurry of incorporations in the "education industry" has led to the production and marketing of integrated "hardware" and "software" components in a variety of evolving instructional systems. In this connection, the entry of a private firm under contract to provide educational services to youngsters in a public system has generated considerable interest, even some apprehension, within educational circles. In what might be considered an exceedingly risky proposition, Dorsett Educational Systems, Inc., of Norman, Oklahoma, committed itself to assuring successful learning on the part of selected students within the Texarkana school system. Perhaps more significantly, the student clientele to which Dorsett is directing attention are those learners that have exhibited some difficulties or deficiencies in performance through traditional classroom teaching procedures. This contractual arrangement, completed after 17 formal bids had been received from such giants in the education industry as RCA, IBM, and McGraw-Hill, Inc., is watched with unusual interest since the company has entered into a "no-results, no-pay" contract.* When one examines the

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*Morton[42] reports that the company will be paid $80 for each student it can raise one grade level in eighty hours of instructional time. The payment goes up progressively to a maximum of $160.67 if Dorsett can improve its student in fifty hours or less. Similarly the payment goes down if it takes longer. If, after 168 hours a student still has not been raised one grade level Dorsett gets no payment at all for the time it has spent on him. Dorsett is confident that it can raise each student three or four or even more grade levels by June 1970.

instructional system which Dorsett has engineered for this purpose, the preponderance, again, of a variety of audiovisual and auto-instructional devices is in clear evidence.

(b) higher education media applications

With varying preciseness and sophistication, a number of universities and colleges have resorted to the sustained use of instructional media in their attack upon problems involving student numbers, diversified curricula, shortages of specialized staff, and limited space and facilities. Illustrative of these institutions are Oklahoma Christian College, Oakland Community College in Michigan, Purdue University in Indiana, and Bucknell University in Pennsylvania. Let us examine these approaches briefly in order to ascertain how they went about reconstituting the instructional process.

Oklahoma Christian College, as reported by North,[43] began with an audio distribution system enabling students at 720 positions to have access to any of 136 program sources from a central distribution location. Subsequently, the number of positions was increased to 870. Audio tapes made available through the system were prepared largely by faculty members and these are often combined with workbooks used by the student while listening to tapes. Studies of this method have led to the claim that "it could be used successfully to conserve teaching time while producing equally good results when compared to conventional lectures." At the time of this report, 35 courses had become more or less revised to make them amenable to reproduction and dissemination via the recorded tapes and other media. High interest is reportedly exhibited in the Oklahoma Christian program as representatives from over one hundred colleges and universities have

visited the campus to observe the system in operation.

Oakland Community College in Michigan serves a varied clientele during day and evening classes. The college and its faculty have committed themselves strongly to an individual audio-tutorial system relying similarly upon tape-recorded instruction made accessible to individual students at times, largely, of their own choosing. Here too, this college has become an exemplar for other community colleges exploring such applications of self-instructional systems.*

Some years ago, a faculty member at Purdue University, Dr. S.N. Postlethwaite, developed a comprehensive system of print, audiovisual, and specimen resources in an undergraduate biology course.[44] In his design, Postlethwaite rejected the primary use of the lecture method and committed himself to a media-based instructional system with strong emphasis upon learning and learner engagement. With tape recorded information and instructions as the chief integrating mechanism in the learning tasks pursued by students, the instructional package has been employed with fair prospects of success in dealing with the unfavourable teacher-student ratios in the department. One interesting developmental feature in this approach is the fact that the original audio tape is generally prepared incidentally as an instructor engages himself in a generic teaching situation with a single student in his office. The resulting tape recording is then made available to the larger student body.[45] An

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*One graduate student currently at the University of Calgary, Mr. Neil Webber of Mount Royal Junior College, visited a community college in St. Louis recently where an adaptation of the Oakland instructional system was engineered. Mr. Webber reports that faculty in St. Louis have augmented the auto-tutorial system considerably with varied and flexible face-to-face instructional activity on an individual, tutorial, and small-group basis.

indication of the success with which this systems approach is being applied is provided by Weisgerber[46] who reports that "students have evidenced both greater achievement and greater appreciation of the faculty, as signified by their selection of Professor Postlethwaite as the campus' outstanding teacher".

Another "Q and D" (quick and dirty) method was observed in use at Bucknell University where similar efforts are calculated to improve instruction through the extensive use of tape recordings and related devices.[47] Beginning in the area of biology, staff approached the task by attempting to identify the structure and objectives of the course and specify the nature of the terminal performances expected of students. The intriguing feature in this effort is the manner in which the project is preparing and accumulating a series of taped presentations that will subsequently be made available through a dial-access information system on the campus. Dr. J. Edling of Teaching Research in Monmouth, Oregon, who had occasion to visit Bucknell University and observed the program at first hand in a national survey of individualization practices in the schools, observed, in the course of a personal conversation with the author, that the faculty member has his lecture recorded on tape verbatim and a set of simultaneous photographs are taken of any concomitant visualizations that were produced on the chalkboard. Later, these visualizations are duplicated on paper and sequentially noted to permit their use during the replay of the taped lecture by individual students. A third step in the procedure requires the eliciting of questions from students in response to the taped lecture and these become points on which the instructor provides further elucidation and clarification. Such additional information is then also tape recorded and attached to

the original lecture for use in subsequent playback circumstances. Through this "quick and dirty" method, staff at Bucknell University has been able to accumulate a fair supply of auto-instructional recordings. A point of further significance, however, is the intention to move into subsequent phases of refinement by the sharper delineation of objectives held for the course in question. One project leader observed that this casual approach which, while admittedly primitive when compared with tested systems of instruction, still makes possible relatively easy introduction of new teaching procedures that will likely produce results comparable to the usual outcomes of conventional lecture-based teaching.[48*]

Many of these resources can be and have been developed by and within existing institutions through procedures that are comparatively simple to institute and maintain with technical personnel with local training and experience. However, the preparation of instructional resources and the design of instructional systems with university faculty members who are typically not prone to consider seriously newer modes of instruction will obviously require the engagement of highly skilled, experienced and mature instructional and media specialists. In addition, the necessary support staff would have to be provided to assure at least minimum acceptable quality in the materials so produced. In any case,

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*Numerous examples of similar applications of audiovisual packages are regularly reported in journals such as Audiovisual Instruction and Educational Screen and Audiovisual Guide, particularly in areas involving psychomotor learnings.[49] In this province, universities of Alberta and Calgary make regular uses of television, audio tapes, and color slides as well as 8mm motion picture cartridges in those areas of teacher education where these devices make possible individual learning by students. In some technical areas of instruction at Northern Alberta Institute of Technology, similar applications of media have been introduced.

the "quick and dirty" approach, depending as it does on lesser sophistication and elaboration in the technical support system, can be readily explored within almost any existing educational organization, at the grade school as well as post secondary levels, which is concerned about the provision of increased opportunities for learning under economically feasible circumstances.*

PART III

TWO MAJOR CONCERNS

Two problems of universal concern face the designer and implementer of new instructional systems:

(1) the readiness of teachers and students to accept instructional technology; and

(2) the costs of instructional technology.

Readiness to Accept Instructional Technology

The acceptance of innovations involving educational media and technological devices has been subjected to fairly systematic study during the past two decades. Apart from obvious reasons such as unavailable material, inadequate physical conditions, unreliability of equipment, and lack of skill, a number of these investigations identified the fact of "teacher inertia", sometimes evident even under favourable administrative conditions.[50, 51, 52] Generally, however, following a period of

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*The use of the tape recorder and an individual or small group "listening station" is in increasing evidence as classroom teachers strive to differentiate experiences for learners. In most cases, tape recordings are prepared locally by the teachers themselves.

exposure and experimentation with the newer media in the classroom, one can expect a gradual change toward the positive in a disposition toward acceptance of instructional usage of communications media and other devices.[53] Particularly revealing was a recent survey of teacher judgments of instructional television in connection with the Alberta Department of Education's pilot projects in television instruction. This survey produced evidence that the greater majority of the teachers exhibited fairly acceptable and positive judgments of the value and place of television in the classroom.[54] Equally suggestive were the results[55] of a two-year study of individualized uses of audiovisual media in the Etobicoke public school system during which teachers participating in the experiment commented upon the prospects for a system-wide extension of the concept. When opinions and judgments of teachers in the experiment were compared to those of a comparable group of teachers not participating in the project there is a suggestion of continued reticence among those not exposed to the technological fact in the classroom. The project teachers exhibited a "let's get on with the job" disposition while the non-project teachers appeared to be preoccupied with inhibitors and obstacles that seemed to defy any efforts at modification, at least through the available mechanisms and resources. Important, however, is the determination of the administrator to create the necessary facilitating conditions by providing assistance and resources as well as assuring the adequate functioning of devices and usefulness of materials.

The attitudes of students have been examined from two standpoints:

(1) attitudes toward the subject matter of the course; and

(2) attitudes toward the medium of instruction. A number of studies have focused upon this problem.[56, 57, 58, 59, 60, 61] Generally, student attitudes toward the subject matter are not differentially affected by the particular mode of instruction though one study[58] found that high school students reacted less favourably to a course when it was taught by motion picture. With respect to the judgment or preference of the medium of instruction, college students generally prefer "live" instruction, even under conventional circumstances, then would rather have available television instruction in ordinary classrooms to television in a lecture hall. The last preferential choice appears to be large assembly group instruction, again in the "live". One significant indication arising out of these studies is the expectation that the attitudes of students toward television may be more accurately reflect attitudes toward the instructor, the total instructional situation, or to the content of the course. In a two-year study of experimental physics instruction in two high schools, the author[60] found that students are more likely to feel that they are "getting something out of the course" if they judge that the school, the teachers, and the instructional circumstances provided represent an "all out effort" to assist them in their endeavors. It would appear that students, particularly in the upper grades and at the university level, may well be more inclined to judge their own performance as a function of deficient personal effort <u>if</u> they observe that the institution has made a serious attempt in facilitating their learning.

A further reference to teacher and student acceptability of newer technologies is noted in the Commission on Instructional Technology's report to the United States President and Congress.[62] The report includes

the results of a 1969 poll conducted for LIFE by Lewis Harris and Associates, Inc., which show that a large majority of high school students and their teachers were eager for innovations but, "one innovation got an overwhelming thumbs-down from the students: teaching by film and closed-circuit television. The reason, they said, was that it cast them in a passive role and throws out class discussion."*

Of course, two assumptions underly studies of student and teacher preferences and attitudes toward course content and instructional methodology. One assumption is that attitudinal disposition or a liking for a particular procedure or subject matter will be positively correlated with learning. This assumption was not borne out by studies such as those by Twyford[63] and Merrill[64] who failed to find positive correlations between students' "liking" of particular sequences in an instructional film and a television program and their learning from those sequences. It would appear that learning, at least in these instances, is more likely to be a function of the factual information concisely presented and in sufficient quantity, with the conveyor device being of relatively minor importance, at least as far as the effect of attitude is concerned.

The second assumption that underlies the relevance of studies in this area is the suggestion that attitude toward content and, particularly, instructional procedure, is or should be a key determinant in selecting

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*One instructor at the University of Chicago reported in a personal communication to the author that his students did not prefer televized instruction because "they could not ask questions". Yet he allowed that, from his observations, he was not obtaining any greater numbers of questions in the live instructional situations. It would then appear that students criticize television instruction not because they would in fact do more asking and commenting but want to feel that they would be able to engage in an exchange if they were moved to do so.

techniques and methods of instruction. This assumption ignores the growing problems of the costs of alternative modes of instruction, increasing numbers of clientele and the diversification of educational programs. The realities in the next decade or two point to a veritable explosion of demands which will strain available resources to the utmost in meeting the mandate for improved quality as well as quantity education. In this regard Finn[65] makes the point boldly when he suggests in a discussion of current issues, particularly in higher education, that present student activism and unrest in universities reflect

> dissatisfaction with the abstract, status-oriented, large-scale organization of the college and university characteristic of a technical culture. Since a return to the colonial colleges is impossible, solutions to these problems too, must be found in technology, although the students' spokesmen would not understand this.

With respect, then, to the disposition to accept or reject instructional technology, it can be said that acceptance or rejection of new media and devices in education will be strongly influenced by the presence of supporting conditions and facilitators within the organization. Secondly, further exploration and development of technologies in instruction will likely have to be pursued on a broken front, beginning where there are distinct indications of readiness among select staff members and the requisite institutional support system in order to move a development forward. With respect to student reaction, it will be reasonable to expect growing resistance to technologically mediated instruction, especially in higher education, since such developments will be regarded as further impersonalizations of the teaching process. It cannot be stressed too strongly that more personalized and humanized interaction must be available as <u>concomitant</u> facilitation in instructional systems that engage

mechanical and electronic devices in some sustained way.

At the same time, it should be recognized that the informed and responsible application of newer devices to instruction promises to generate new opportunities and latitude for devising varied instructional arrangements that feature tutorial and small-group encounters. Indeed, it is argued here that time and occasion for such diverse activities and opportunities can emerge from and be facilitated by the integral and sustained uses of technology as a major instrument of formal instruction.

Costs of Instructional Technology

Costs of instructional technology, including capital investment and operating expenditures, continue to loom large as problems for schools and universities. In most instances, embarking on the use of instructional media, particularly of the electronic variety, requires fairly substantial outlays of often scarce resources. These costs, however, vary widely, depending upon the nature and range of equipment and allied services provided. The most recent tabulation of cost information (in the United States) was recorded in the report of the Commission on Instructional Technology[62] where the following figures were presented: $50 to $60,000 can cover the initial costs of a dial-access information system in a college or university but these costs can run into the hundreds of thousands. On the average, a closed-circuit television system costs $178,000 to install and can be operated for $86,000 per year. Nine self-instructional units of a physiology course developed and produced in Michigan State University making use of carrels, audio tapes, slides, 8mm films, and programmed texts cost $40,000. A simple televized lecture can be produced for as little as $50 an hour while a presentation making

use of film and other visual materials might cost as much as $6,000 an hour. Computer-assisted instruction of the drill and practice variety may cost up to 27.2 million dollars a year in a school district of 100,000 students; by using the computer more creatively as a sort of tutor can put the price up to 71.8 million dollars.*

In the same Commission report, further costing was done on the basis of guidelines for standards of equipment and materials required for media programs of "good" quality as presented by the American Library Association and the National Education Association in 1969. Twyford, Chief of the Bureau of Classroom Communications of the New York State Department of Education reviewed these standards and estimated the dollars represented in the proposal if these were fully implemented in one year (presumably in the nation's public schools, private schools, and institutions of higher education). He calculated that, once this investment had been made, it would cost 11 billion dollars per year to operate and maintain as systems of instructional technology in these educational institutions, including the replacement each year of the materials and equipment being worn out or becoming obsolete. Comparable standards have been put forward by the corresponding Canadian professional groups in two publications, Standards of Library Service for Canadian Schools[67] and Media Canada -- Guidelines for Educators.[68] Since these guidelines were published in separate documents, and tend to overlap in some measure, they present more of a problem to cost out in a way similar to that done by

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*The source of this information is indicated to be a firm of cost consultants, Booz Allen and Hamilton, Inc., who prepared a report for the Committee for Economic Development.[66] A fair costing of CAI calls for a 24 hour per day usage concept and multi-service applications in a regional network of separate administrative units.

Twyford in the United States.

Other attempts to assess the costs of media applications, confined themselves to particular courses, media uses, and institutions. Carpenter and Greenhill[69] made a careful assessment of costs in relation to instructional procedures and determined that television at the university level (at least in this project at Penn State University) is more expensive than conventional instruction unless several hundred students were taught in a particular course. Siebert[70] found at Purdue that student numbers of between 150 and 275 in a given course would provide a break-even point in expenditures between televized and live instruction. One difficulty in assessing these estimates is the comparability of expenditure items included in the analysis and the sophistication and complexity of the media applications and the overall systems design. Clearly, great variations can be expected depending upon the demands of a particular subject discipline, the elaborateness of capital installations, the complexity of production procedures, the preparation of original visuals, etc. Particularly important in the assessment of costs would be the frequency with which a given program or production could be used in subsequent instructional situations in order to reduce, on the average, total expenditures over the long run. It should also be noted that costing instructional technology in isolation is one thing; assessing its reasonableness is another. The latter will, of necessity, have to take into account the rising educational costs that are in distinct prospect even as we continue to employ conventional teaching procedures in existing instructional organizations. The key question is, not what additional costs would result from the systematic incorporation of the various

instructional devices but what expenditures would be required to meet the increasing demands for education that lie ahead?

Both these problems, the acceptability and the costs of the newer instructional technologies, dramatize the hazard of imposing modern learning devices onto the existing instructional system in an isolated, piecemeal or unsystematic manner. Particularly damning is the common practice of introducing a new device or technical procedure as an appurtenance, a "graft" onto the prevailing configuration of instructional procedures. The graft, if attempted in mere additive fashion, simply won't "take". One has to reconstitute large sectors of the established set of instructional operations and their respective agencies in the pursuit of new, more effective instructional designs as comprehensive "systems".

PART IV

IMPLICATIONS FOR COMMITMENT AND ACTION

The preceding analysis and discussion give rise to a set of propositions and claims which have high relevance and significance for the contemplated introduction and exploitation of instructional technology. It should be remembered that these observations, while they are stated in the form of proposals or prescriptions, are based as far as possible upon the available repertoire of research evidence and developmental experience and reflect the hopeful expectations of practising specialists in the field. These implications are presented under the following headings: (1) Resources as Generic Components in Instructional Designs; (2) Developmental Requisites; (3) Multi-Institutional Efforts; and

(4) Toward Enlarged Educational Opportunity -- An Alternative Model.

(1) Resources as Generic Components in Instructional Designs

(a) It can be claimed with reasonable confidence that the newer communications media and devices can "teach", that is, they can be expected to produce essentially equivalent learning outcomes in the form of typical student achievement when juxtaposed against more conventional forms of instruction. Indeed, the plethora of the "no significant difference" finding in research on comparative instructional procedures has, at least implicitly, placed the burden of proof upon the traditional modes of instruction to justify their own existence. It can also be argued that, in the context of multiple manipulations of a number of interrelated instructional components, the systematic introduction of the newer technologies can well be expected to "create" new time and provide new latitudes for generating more accommodating learning environments.

(b) The traditional conception of the instructional role of communications media and related devices as that of an "aid" to the teacher must give way to an emerging complementary role as more direct mediators of learning, and increasingly, through independent and autonomous use by the individual learner. With this shift in orientation, a greater abundance of material and resources will be produced with substantially different formats and designs in order to accommodate such individual learner use.

(c) Experience to-date with the instructional use of the available technologies emphasizes the importance of more precise and clear articulation of learning objectives which are intended to represent the

ultimate goals in a given course or curriculum. In turn, teachers and instructors, whether in the schools or other institutions of learning, are remiss if they continue to teach in the usual group-oriented ways on the expectation that defensible learning goals are being attained. There is an increasing need to introduce more discipline and systematization in the selection of teaching method and in the designing and developing of particular media themselves. Faculty members and teaching staffs in general can accomplish quick gains through the use of the "Q and D" method in order to proceed more expeditiously into the developmental phases of instructional designing. Such a tactic may well be necessary, given the typical limitations on staff time and available resources. It is simply a case of having to keep on doing the job while trying to improve upon that job at the same time.

(d) Any examination of instructional resources and their integration into instructional systems must make significant provision for the central role of the computer and the evolving information systems.* In a decade marked by rapid technical development and change in the computer hardware, rather limited explorations in schools and universities have gone forward, due largely to high capital and operating outlays and the unavailability of usable programs. In describing the present state of the art, Hallworth reports that,

> Applications of digital computers to teaching and learning are at present developing very rapidly. They have been made practicable by the third generation of computers, which is capable of supporting time-sharing systems. In other words,

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*This section has been written with considerable assistance from Dr. H. Hallworth, Professor of Educational Psychology, University of Calgary, and his recent paper describing the present computer developments in the Faculty of Education.[71]

> a number of terminals may be attached to one computer and may be operated simultaneously by users conducting 'conversations' with the computer as if each had the machine to himself. It is already possible to buy a small-time-shared computer . . . for the price of a laundry and dry cleaning room in a high school. The so-called 'fourth generation' of computers is now beginning to appear, characterized by medium and large scale integration, and by smaller size and lower cost. We may therefore expect a further extension of computing facilities into schools.[72]

Indeed, Wallin, in a recent survey of administrative uses of some form of electronic data processing (EDP) in Canadian schools, discovered that, out of 23 school systems which responded to his enquiry (thirty of the largest school systems had been approached) 61% were "users" and 39% were "non-users".[73] The larger the system, the more likely it would use such a facility for general administration purposes, teacher accounting and student accounting, though comparatively little use of EDP is reported to have been made to research school problems, to arrive at decisions and to shape future plans.

The use of the computer in instruction has taken various forms: drill and practice systems, tutorial systems, and dialogue systems.[74] Prevailing applications tend to emphasize the first two uses with predominant attention to drill and practice. Perhaps the most significant and ambitious program of research in computer-assisted instruction is that conducted in Stanford University. Here a group of researchers are exploring tutorial programs in logic and algebra on the university level and drill and practice programs in elementary and junior high schools in arithmetic and reading.[75] Feldhusen and Szabo observe that most applications of computers for instruction have involved the information transmission model of learning, while many of the curriculum development projects have stressed the information processing model in

developing materials and procedures for instruction.[76] They make an appeal for the exploitation of the unique power of the computer in providing instruction in information processing in such forms as gaming, simulation, problem solving and enquiry. While the latter areas, they suggest, are represented in CAI projects, these are nevertheless outweighed considerably in quantity by the didactic or information transmission type of programs.

An example of the problem-solving application of the computer is described by Hallworth[77] in the area of mathematics where mathematics students in high school have access to a terminal and use the computer to solve problems in mathematics. In the course of the instruction, the students are introduced to a particular computer language and have access to the terminal which is attached to a time-sharing system. Hallworth reports that "it has proved possible to teach FOCAL (a computer language) to both junior and high school students with no difficulty. At both levels, students have shown great enthusiasm and have written quite sophisticated programs."[78] Riffel, in a mission proposal to the Alberta Human Resources Research Council on the use of computer technology in education, similarly emphasizes the advisability of the use of the computer as a problem-solving tool.[79]

It is in the daily management of instructional activities, however, where the computer's contribution has become more tangible. This use of the computer takes advantage of its enormous capability for storing, retrieving and manipulating large amounts of information. The two major projects referred to above as exemplars, Individually Prescribed Instruction and Project:PLAN have both built into their instructional systems a distinct computer capability in order to make the programs feasible of implementation at the school building and classroom levels.

If a student will be guided appropriately in his instructional activities in accordance with his present level of performance, abilities, aptitudes, and previous experience, teacher and learner will be compelled to examine and analyze a large amount of detailed information about learner characteristics as well as the interaction between the learner and the instructional program. While IPI calls for the engagement of teacher aides to help in such data processing, a computerized classroom management system has been developed for the program.[80]

Hallworth is presently engaged at the University of Calgary in developing a workable management system for the IPI project school in Calgary on a small computer which is more immediately practicable in many localities. Highly promising explorations of the computer in this and related areas of use are also in marked evidence at the University of Alberta, under the direction of Dr. Steve Hunka in both medicine and education.

Of particular significance is the possibility that computer-based management and instructional systems can take on the "attributes of realtime control systems."[81] Sackman defines realtime education as the "continued development of human knowledge and skills when they are needed and in time to resolve problems as they arise." Computer-assisted instruction of the tutorial variety, computer analysis of data to facilitate problem solving, and computer-based data storage and analysis for making management decisions in the learning environment, all can contribute to the emancipation of the learner from the constraints of traditional schooling practices. When an integrated system of instruction enjoys the added power of the computer, any learner, youth or adult, would be enabled to pursue his education at the time

that he senses a need for the acquisition of new knowledge and skills. Furthermore, the possibilities for enlarging the occasion for creative work and for human innovation have not been overlooked. One observer points out that,

> . . . preliminary analysis of technical and scientific creative activity suggests that such activity consists of short intervals of insight, invention, and decision making interspersed among long intervals of 'staff operations'. Most of the student's time is spent in getting into position to take a step, and only a small part of it is spent in taking the step. No one knows what it would do to a creative brain to think creatively continuously.[82]

The implications of computer developments for the future of education in Alberta are clear. While the cost and complexity of the hardware in computer technology discourages many a system from extensive commitment, there is little doubt that the assistance of the computer will be required in the proper functioning of more effective instructional and administrative procedures in schools and universities in this province. At the least, the instructional process will be aided immeasurably by the sustained attention, assessment, and reconstruction that are made possible by the continuing monitoring of operations on a "real-time" basis; such monitoring, in order to lead to significant improvements in ongoing operations, will have to be accomplished through the massive capability for data storing, analysis and retrieval of the computer. It is therefore urged that educational institutions in Alberta must, of necessity, maintain currency in the larger field of computer technology and continue to explore and develop local applications which promise to extend and improve educational opportunity in this province throughout the next decade. Alberta has already an established capability in the form of technical installations, specialist

researchers and program developers. These must be sustained in their efforts. Their contributions will be felt in distinguishable form increasingly as the schools and universities make serious efforts to come to grips with the problem of student numbers and the growing necessity for improving the quality of instruction.

(2) Developmental Requisites

(a) A meaningful attack upon current and future problems of instruction can be initiated by institutions long before sophisticated and elaborate facilities and resources are made available. Current developments suggest that many a school, university, or other educational organization can embark on significant innovations by using the simpler devices, such as the tape recorder, that make it possible for teachers and instructors to introduce new degrees of freedom and a wider array of alternative opportunities into the existing instructional environment. It is urged that, at the outset, the emphasis should be placed upon the simplicity of technical processes and devices employed, while taking serious account of the ease of usage by learners, and the continuing possibility for simple and quick modifications of components of the system as well as the entire configuration as suggested by monitoring and evaluation processes.

(b) In any such innovation, however, new physical arrangements or technical adaptations of old instructional facilities must often be made in order to accommodate the use of a new method or device. Again, the simpler the device, the less disrupting and, typically, the less expensive would such adjustments be.

(c) Whatever the scope of the instructional innovation, the more the "systems" approach is employed and deliberate attention

directed at the way in which a number of interrelated components or factors in the instructional process can be manipulated, the greater the likelihood that significant and productive changes will be realized. In any case, organizations need to guard against the application of single devices or media in isolation from the other determinants and processes that go to affect the outcomes of instruction. The single-medium innovation is more likely to prove generally unsatisfactory and, equally important, more costly in terms of the returns obtained.

(d) Institutions bent upon exploring new instructional methods cannot expect to draw upon a large repertoire of warrantable insights. They will, of necessity, have to continue to rely upon the leadership and guidance of competent staff in the subject matter discipline, in instructional design, in evaluation, and in various communication and technical areas. Such staff must bring to bear wide experience and intuitive sensitivity with some flair for imaginative speculation about new possible arrangements in instruction that can be explored, refined, and authenticated. Certainly in the initial stages of redesigning instructional procedures, the task requires not so much an abundant and elaborate provision of technical hardware as it is dependent upon competent leadership and expert support staff.

(e) Competent leadership in the instructional team needs to bring to bear a sense of delicacy and tact, particularly in high schools and institutions of higher learning where staff members generally assume that they have the necessary expertise in teaching. It should also be emphasized in this connection that it is equally important to procure adequate technical personnel to oversee the proper operation and maintenance of equipment and the institution of efficient logistics in

equipment deployment. Too often do we find aggressive and enterprising administrators providing the requisite capital equipment and leaving ignored the need for sufficient provision for proper handling and maintenance.

(f) Institutions may well find that they do have on staff the necessary expertise in order to move significant instructional innovations forward but the locations of staff members may well involve a number of different constituencies in the organization. Some universities, for instance, have attempted to solve this problem by establishing an office of instructional research or a division of instructional development which then becomes instrumental in planning and coordinating the available pool of staff on campus in order to make significant headway in the designing and implementing of new approaches to instruction. The importance of this office has been assessed in such a way that individuals, heading up these agencies, have been given rank and status comparable to that of a vice-president or a dean. Such agencies acquire additional importance as they are given the responsibility to oversee continuing evaluation and monitoring of instructional activity as a means of perfecting the quality of instruction in the face of rising enrollments and costs.

A similar systematic effort in grade schools to direct more deliberate attention to the planning, implementation and evaluation of instruction in schools is reflected in experimental programs such as Individually Guided Education in the Multiunit Elementary School[83] and Individually Prescribed Instruction (IPI).[84]

(3) Multi-Institutional Efforts

(a) When one envisions the magnitude of the task to improve educational opportunities in the decades ahead, there is a sense of being overwhelmed in the face of generally inadequate resources available to any given institution or organizational entity. It is patently obvious that considerable need exists for multi-institutional and collaborative efforts in order that unwarranted duplication of activities and resource expenditures can be avoided.* In addition, it is unlikely that the independent efforts of autonomous staff members or organizations will succeed in solving the emerging problems ahead. Collaborative arrangements must be forged to permit a larger political entity such as a province to arrange for the development of comprehensive and instructional systems on the basis of the unique strengths and capabilities of those collaborating member institutions. Beginnings of such an approach in the media area have been made with the establishment of television production facilities in Edmonton (MEETA) and Calgary (CARET). The Department of Education is also considering the establishment of a video tape reproduction service which will enable school systems to procure television programs for their own keeping and use. With a genuine effort at systematic collaboration and coordination of often scarce and competent resource staff, this province can generate the development of a wide array of instructional resources for use at various levels of education and in a multitude of geographic localities.

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*Dr. L W. Downey, in another position paper written for the Commission on Educational Planning, "Organizing a Province-Wide Educational System", deals comprehensively with this problem.[85]

(b) The possibility for developing a network of instructional resources, facilitated either by mail, telephone, or electronic dissemination, is not only a technical feasibility, but, once more, offers considerable promise in enlarging the reach of complementary resources located throughout the province's educational institutions.

(c) As was strongly urged by the American Commission on Instructional Technology, there is a similar need in Alberta for establishing a search and evaluation agency that could serve numerous educational institutions in locating, assessing, and distributing viable packages of instructional resources that have been produced by other educational institutions or by commercial enterprises.

(4) Toward Enlarged Educational Opportunity -- An Alternative Model

In view of the fairly well established capability of instructional media to extend the "reach" of instruction, it is questionable whether educational organizations can continue operating entirely on the assumption that the learner must be moved bodily to a school or university and remain in a given geographic location for a particular period of time, often for a sustained number of months or years. This model, as an exclusive guide to educational planning, can now be challenged in the light of the dissemination and related capabilities of the various instructional technologies. When one combines increased accessibility by learners with enlarged opportunities for differentiation in content, pacing, timing, length of exposure, self-evaluation and the like, possibilities for injecting new power as well into the instructional process are considerably enhanced.

The basic characteristics of this model are by no means new -- their essential elements have been isolated features of numerous experiments with television, programmed instruction, extension services, group leadership and membership and, more recently, instructional systems packages. These elements, however, have been incorporated into what is hoped to be a more viable set of instructional operations.

Some years ago, Erickson and Chassow[86,87] tested the use of television-based instruction in a number of courses in the junior college. This instruction, via television, was supplemented however considerably by problem-discussion sessions with instructors periodically throughout the course. In addition, students submitted papers and, of course, took tests and examinations at intermittent times. In a similar vein, Harvey White taught the renowned physics course on Continental Classroom, a network presentation attracting what was claimed to be over 500,000 high school students and teachers in an extra-curricular study of physics. Opportunities were similarly made available through local universities and their correspondence divisions for such students and teachers to obtain credit. A more recent example of the impact of sustained television use is the television series Sesame Street, which is designed for the pre-school audience and was telecast throughout the United States during the past year. This series is now being considered for telecasting in Alberta this fall. Teachers and parents alike have recognized the enormous attraction that this imaginatively produced television series of programs has for pre-school youngsters. Children are enticed, enthralled and, in a real sense, acquire incidental learning of language as well as participate sympathetically in creative expressions during the programs. The point is that a particular medium, television, has

been allocated the central role for carrying a large part of communication or instruction forward. In most instances, the format of presentation in these television programs is not significantly different from that represented in the lecture-type instructional effort in conventional teaching procedures.

(a) assumptions underlying the model's development

-- Since this province faces acute pressures on the high school and post-secondary levels of education in the decade ahead, the model's development has been somewhat biased toward that clientele of general adults, high school students, and college-destined youngsters. Its essential applicability, however, may also be seen as relevant for some junior high classes. This clientele will be either academically oriented, vocationally destined, or even now professionally or vocationally engaged.

-- Within the next foreseeable period of time, institutions of learning in this province will continue to offer courses organized around traditional disciplines and the learning expectations and criteria that will be employed will not be much different from those in force today. It may well be that a more "cross-discipline" approach to the handling of social problems may be included in the curricula but this eventuality is not precluded by the present model. Even the "problem" or "experimental method" approach to the subject matter would require some alternate format in message design and media uses, but, for the moment, the assumption is that no radical change would be indicated in the general instructional methods employed.

-- It is assumed that schools and universities in the years ahead will opt increasingly for a trimester structure and provide course

offerings throughout the year.

-- Specific recognition is given to the importance of the social component in the interpersonal experiences of the student as a powerful force that will influence his learning. The model similarly rejects the current practices of allowing three, four or five periods of "live" encounter with a teacher of forty or fifty minutes of length each per week. The use of teacher or instructor intervention is not only shaped in a different format, and, essentially, is media based, but the instructional purposes to be served by such intervention will also dictate its form and character.

(b) purpose and basic postulate guiding the model's development

The essential objective of the rationale within the model is to bring the whole range of instructional resources and techniques for learning within the reach of people in need or who seek or could benefit from a continuing encounter with such resources. The postulate guiding the model's construction is as follows: all instructional tasks that can be committed to a non-human device or medium in the confidence that acceptable outcomes will obtain shall be so committed along with the integral application of complementary and reciprocating agents and procedures in order to establish a feasible and economically defensible system of instruction. This postulate is proposed in the recognition that a good deal of basic input in most course offerings beyond the junior high school grades can be largely managed through live or video-taped telecasts, tele-lectures, telephone hook-ups, as well as the simpler devices such as audiotapes, particularly through cassette playback. Further, physical distribution systems involving book or

library mobiles and delivery trucks can serve additionally in the extension of resources to learners throughout a geographic locality. Even within such cities as Calgary and Lethbridge, where the universities draw most of their students from the local urban communities, the model suggested below would appear equally appropriate as a substitute to the geographic and sustained relocation of learners especially in those introductory courses that attract large student enrollments.

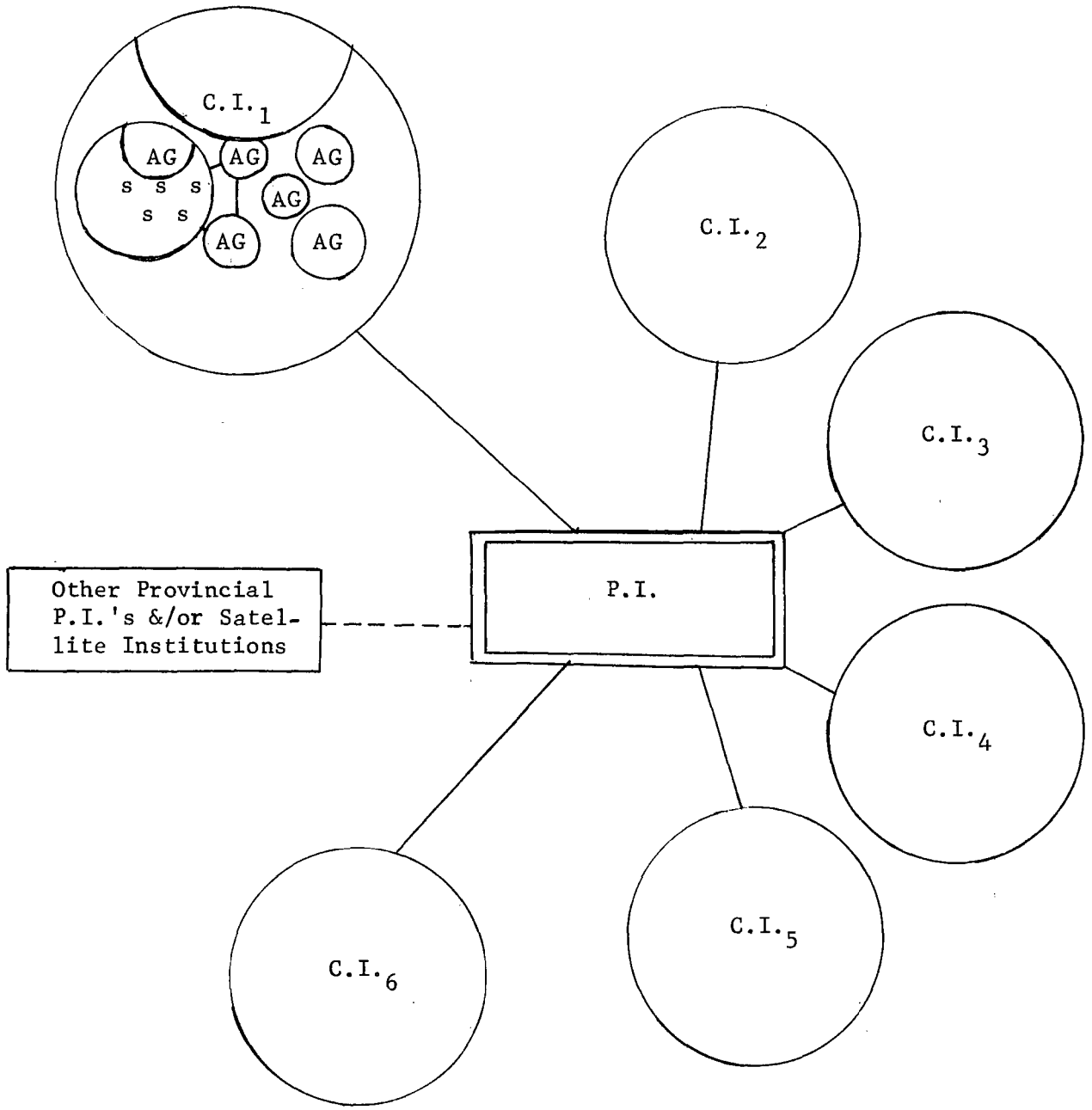
(c) basic structure of the model

This model is composed of essentially two components: a parent institution and a group of community institutes that are linked operationally in an instructional region containing the student clientele.

Parent Institution -- This institution is a university, college, or a large comprehensive high school which acts essentially as a repository of expert capabilities and allied resources including specialists in instructional systems design. This is the "home base" of subject matter specialists and instructional assistants. It functions as the center for planning, implementing and managing, and evaluating the instructional activities throughout the client region.

The functions of the parent institution would be assumed by an instructional team of specialists in both subject matter and instructional procedures. These teams of specialists would plan and develop comprehensive instructional systems in those areas of study offered throughout the region. The team would: (a) survey client need and/or interest in the subject area within the region; (b) develop a rationale linking course purposes and relevant substantive content to appropriate instructional modalities including media resources; (c) evaluate and

INSTRUCTIONAL REGION MODEL



Code: P.I. -- Parent Institution
C.I. (1-6) -- Community Institutes
A.G. -- Activity Group
S -- Student

select ready made available resources; (d) plan and develop specific program units using a variety of media -- television, video tape, mimeographed presentations, articles and the like, including, where appropriate, live telephone hook-up to facilitate two-way communication; (e) monitor the complex of instructional activities and the contributions of related agents or components (here the institution's central data processing facilities would contribute significantly). Particular emphasis here would be placed upon the success with which designated communication functions are performed within the matrix of media uses; (f) student testing and evaluation of related products; (g) periodic circuit visitations to community institutes to meet with students personally and in their activity groups (A.G.); (h) maintain continuing contact with coordinators and their conveners in the community institutes; (i) arrange for periodic problem-discussion sessions at the parent institution as scheduled for student interns making up the activity groups throughout the region.

Community Institutes -- There may be five or six such institutes distributed throughout and comprise the client region with the farthest about 100 miles from the parent institution. At least two such regions may be envisioned immediately around Edmonton and Calgary in the province. "Satellite" regions having similar characteristics might be entertained for the larger towns in the province.

The community institute would expedite local procedures to keep the learner sustained in his continuing learning efforts. It may be housed in any available building such as a local school, library, or a civic office. The institute would have a coordinator who would act as the local liaison officer for the parent institution and whose primary

task would be to assist in setting up activity groups (those students taking the same course in the locality) and expedite locally those procedures including the distribution of resources, the administration of tests, and the return of student work to the parent institution. The coordinator may be assisted by group conveners depending upon the number of activity groups present in his institute.

The community institute may also distribute printed and audio-visual resources -- manuals, syllabi, sequentially structured programs for self-instruction -- and have a ready cadre of local residents who have special competencies in related subject course offerings.

It can be seen that the community institute, in a very real sense, will shape the social and continuing human contacts of the student. It is therefore to be expected that some student counselling, especially problems of course selection, will likely become an indigenous responsibility of the institute.

(d) the student and the social component

Lest it be assumed that this model represents a dehumanized approach to extending educational opportunities, it should be pointed out that the student will encounter significant interactions with others -- his peers as well as instructors and resource specialists -- throughout his course activity. Such interactions or social dialogues will occur in at least the following ways: (a) direct interchange with instructors at the parent institution through a two-way telephone hook-up linking the live instructor with client group stations throughout the region; (b) student-to-student interchange as a constant feature of his activity group membership (indeed, it is likely that a good deal of

peer teaching or co-figurative instruction will occur to the mutual advantage of both participants[88]); (c) student with local resource people as well as coordinator or counsellor in the community institute; (d) instructor visitations to community institutes at pre-scheduled intervals;and (e) student internship representing time on-campus spent by the learner, again at a predetermined and for a particular length of time.

It perhaps should be mentioned that the possibilities for parent-son or -daughter teams occurring within these activity groups is a distinct likelihood. The opportunities for pre-figurative teaching of which Anderson speaks are prominent as well as the occasion for genuine and objective social interchange between members of different generations. The stigma of older adults pursuing their education is likewise not as pronounced as a new ethos can be realistically envisioned within the social structure of the activity group.

(e) some expected advantages of the model

Perhaps the most significant advantage of this model is the fact that the prospect of financing enlarged educational scope in the province is not based upon the assumption of centralization and the establishment of elaborate and duplicated physical if not technical facilities but is based upon the concept of a client region as the essential unit. Indeed, one can envision fairly small but numerous and widely dispersed activity groups throughout a region representing the student body in a given course. The parent institution is not faced with the prospect of having to make difficult choices as to a location where a particular course shall be "offered" within the

region. The parent institution can plan on the basis of all the individuals who would be interested in a particular course in a given region, regardless of their physical location, and institute the technological and social components of this model to produce what would be expected to emerge as a feasible and economically acceptable program of instruction. It is suggested that, as the overall system of interdependent procedures and resources are developed, the parent institutions would take every advantage of the existence of available media packages of instruction and self-instructional kits that may be procured or produced through inter-institutional collaboration. It may well turn out too that the parent institution may also be in a better position, financially, to maintain and advance graduate study and research programs of a more highly specialized nature while at the same time making necessary allowances for instructional programs requiring unique equipment or building facilities and space arrangements for student internships as well as production facilities to create the media based instructional systems.

This alternative model for extending or enlarging the reach of education in the province may well appear to be visionary in some respects and perhaps naive in others. It is maintained however that the model is impellingly practical in this province and could be field tested within a short period of two or three years if a coordinated energetic thrust, powered by a multi-institutional alliance, were engineered.

PART V

THE "SCHOOL" THAT I SEE . . .

I tred now not without a little trepidation, embarrassment and guilt; trepidation, for who among us can comfortably postulate what the image of education will be in two or three decades ahead (prediction) let alone what education should be like (prescription); embarrassment because of the air of omniscience, even arrogance with which any deliberately assumed visionary posture is tainted; and guilt, for who dares to say anything prophetic without committing unavoidable acts of plagiarism. But so be it. Here they are, my tenets of "belief", stated hopefully in a manner of speaking such that a sense of the urgent and the impelling will serve to offset their often trite and esoteric sounding character.

The Learner and Educational Priorities*

(1) I believe that the fundamental challenge confronting man will be to assure his survival as a species and to achieve the full expression of his imaginative and aesthetic capabilities.

(Educational priorities will necessarily demand attention to the problem of maintaining those bio-chemical conditions suitable for sustaining life on this planet. To achieve such a state, man must alter his pre-occupation with purely intellectual, scientific, technical and material advances but must genuinely sensitize himself to those aesthetic qualities of his physical environment -- the beauty of

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*The basic propositions are stated in rather cryptic and bold form. Below each is offered some explanation in support of the proposition. The reader can gain a "feel" for these declarations by confining his attention simply to the propositional statements.

clean air, water, and vigorous and plentiful natural vegetation. Such a change in value and appreciation will do much to stem and reverse the destructive processes that despoil his physical environment. Hence, feeling and phantasy, wonder and awe, mime and dance, play and reverie -- all these will be cherished as much as reasoned reflection of the disciplined mind.)

(2) I believe that the person of the learner must necessarily choose and decide purposes and tactics as dictated by his subjective assessment of felt contingencies and circumstances.

(The condition of life in the decade ahead will increasingly defy long-term prediction and prior preparation. The relevance of information will be judged by circumscribed situational requirements in view of the continuing 'explosion of knowledge". In addition, a rapidly changing and increasingly complex culture will make any comprehension highly tenuous. Social upheavals will result in the growing reconciliation to plurality and the concomitant competition among value alternatives involving human aspirations, life styles, and world views as the only reasonable working ethic of the day. Hence the learner must increasingly select to clarify his own purposes as reflecting the most important concerns and dispositions that move him.)

(3) I believe that the primary sources of individual and personal tensions will emanate from the abrasions in his social relationships.

(It is mandatory that the ailment of social tension and interpersonal conflict not only be offset but that the learner be permitted to draw support, sustenance, and encouragement from a new set of human contacts and relationships which are deeply human -- intensive, revealing, and honest. Educational emphases will have to be placed upon the feelings as well as the thoughts of the learner as he attempts to acquire an awareness of them and the necessary skills and commitments in shaping his own self. His concept of himself will be derived from the sense of worth that grows from his engagements with people and the world around him and from his encounters with the moral and ethical prescriptions that society provides.)

The Learner and Learning

(1) I believe that learning is life and life is learning.

(In a real sense learning is not preparation for life nor are selective encounters with living phenomena merely the instructional vehicles for more effective learning but living and learning are coterminous, they are one. Every act of thought or deed, in some small or large way, affects the awareness of our subjective selves as persons

by establishing, modifying -- diminishing or strengthening -- and reconstituting our capabilities and propensities.)

(2) I believe that there are inner wellsprings to live -- to act, to do.

(We can no longer ignore this central core of feelings that represents in real terms the only conscious awareness that the learner has of his actual being. Of essential concern is the immediate inner and outer world, not the temporally or psychologically distant. "My problem is now, my concern is now, my conflicts are now, my yearnings are now -- these will dictate my action, dominate my thoughts." The school will need to acknowledge and allow for the fullest expression of these wellsprings for action. Unfortunately, they have been throttled and distorted beyond easy repair in some while inhibited by disuse in others. This stark truth of diminished human propensity afflicts the lives of the great majority of the "middle" range of learners and adults who are not alienated but merely disenchanted, are not hostile but merely sullen, are not revolted but merely apathetic. They have no inner resources of mind, emotion or character to gain emancipation through and in the prevailing educational system. They are the real defeated, the ostensible conformists who grow to resent eventually even their own conformity. More than anything, they need to be emancipated from their prevailing stupor and the coercions and constrictions of a school and culture that continue to cajole and to thwart, to beckon and to deny, to arouse and to condemn. Indeed, they grow into "caricatures of what they might have been."[89] The remedy here is to show compassion for the struggling, halting, often random and exhilarating and sometimes fitful efforts of the young to grow into their own. It follows, then, that building a boat or playing with a child is no less "worthy" than writing a poem, or comforting the ill. Surely the aborting of any act in motion, conditioned only by the threat of diminished opportunity or the prospect of ill consequences to the well-being of others, is a denial of the right to live, the right to be.)

(3) I believe that learning and living are, in a very real sense, a function of the social environment.

(Schools have too long been dominated by a purely psychologic, individualistic pedagogy in which the learner finds himself examined, tested, taught and studied in a socially isolated manner. It is my belief that the learner can be and must be sustained in his learning efforts by the cohesion, support, and concern of others. He can go some distance in overcoming the deficiencies of available cognitive materials as represented in the teaching inputs of teachers, textbooks, and the like. The learner will continue to struggle with less than ideally structured learning content if he is functioning in a mutually reciprocating and responsive social environment. This is not to say that we should not get the best materials but our present efforts are exclusively directed at the precise structuring of cognitive content for the individual

isolated learner. Furthermore, the pride of accomplishment grows out of more than the "reinforcement" of a "programmer"; it emanates from an explicit recognition of the worth of his achievements by respected others.)

The Learner and Intervention

(1) I believe that there is a natural rhythm in the act of doing, beginning with an initiation, followed by sustained undergoing and culminating in a consummation of experience.

(There shall be no insistence that attention be coerced or effort directed in a particular pre-selected direction. There are unlimited opportunities for the person to select goals and channel his efforts in keeping with his inner predispositions. The expression of goal-oriented effort is a natural process involving the arousal of excitation and the consummating activity that leads to satiation or fulfillment through the resolution of a particular problem or the completion of a given task. This natural rhythm in meaningful pursuits ought not to be contaminated by such conventional strictures as rigid schedules, confined movement, enforced silence, and the like.

(2) I believe that the person must enjoy optimal choice as to where and how he spends his time and effort even at the risk of generating extraordinary competence in some areas of undertaking and virtual ignorance in others.

(I have confidence in the play of enthusiastic commitment as a force in life-long learning wherein engagements will eventually bring to the fore the necessity for acquiring certain skills or mastering particular content in order to achieve consummate satisfaction in the task. Most persons are specific or situation-oriented -- they want to do particular things in the service of particular needs. They are frequently product-oriented -- build a birdhouse, assemble a radio, experiment with mice, paint a picture, play a song, etc. These specifics are the points of attack which engage the learner's efforts as long as he has some reasonable hope in overcoming immediate and foreseeable obstacles to the realization of whatever goal or purpose he has set for himself. To be sure, there are those who talk of cultural requisites and the necessity for systematic and authoritative "social intervention" in the life of the youngster. Yet I have full confidence in any person's acquiring minimal competence in those requisite areas as he is enabled and encouraged to surge on in an energetic pursuit of what is "real" for him, for in that pursuit he will encounter those necessary "contextual requirements" of which Martin speaks and which, if his zest is genuine, he will fulfill in due course in any case.[90] Tragedy or no, who is to

say that a skewed profile of competence reflects invariably a lesser "quality of life"?)

(3) I believe that learning environments must assist the person to become a more effective functionary in his practical and transactional world.

(We still continue to try to entice the learner into intellectual engagement on the expectation that "the excitement of enquiry" into problems of a discipline will arouse and energize his sustained engagement. While this may be true for some, perhaps the more able learners, it has not been shown to succeed yet with sufficient effectiveness to attract and hold the larger body of learner clientele. The difficulty is that we continue to try to make a pure act of enquiry into a discipline as exciting and potent as the impetus for real action in a real world. We continue to try to make the learner a physicist or mathematician in embryonic form rather than simply assist a person to become more competent in giving shape to his conception of himself as an evolving individual. This is not to say that authentic knowledge is not important; it is merely to acknowledge the doubt that we can really expect to make competent enquirers out of most if not all learners in a hidden but nevertheless still direct assault on traditional subject matter disciplines. The authentic person will more likely emerge from an educational process which helps articulate where he is now, what he wants to become, what it is in him to become, what he needs in the process of becoming, what assists are available to him as he pursues various avenues to becoming, and what expectations, opportunities and degrees of freedom he will likely encounter as he furthers his own powers of self-direction.)

(4) I believe that we will cultivate a sense of social responsibility in people only when we increasingly provide them with the necessary antecedent circumstances that allow freedom of choice among a variety of available alternatives.

(If learning and living involve the will to act and to do, then clearly no skill, attitude, or commitment can be acquired without the direct engagement of the learner in learning encounters. I have yet to understand how any form of responsibility or accountability can be realistically expected from learners when the necessary conditions for acquiring such a disposition do not pertain: confrontation with a significant problem requiring a decision or choice, an occasion for enquiring into the nature of the problem in order to articulate its significance or relevance for the person, the examination and consideration of alternative choices of action that are open and available to the learner, the selection of a particular course of action calculated to attain the best resolution of the problem in question, confrontation with the consequences of that course of action both to the learner and others since his own

powers of self-development are contingent upon the assistance and involvement of his peers and other associates, an acknowledgement that whatever success or failure he has experienced can be directly linked to prior acts or judgment or consummation which he himself saw fit to initiate. On both pedagogical and even moral grounds, the right and necessity of free choice represents a fundamental tenet in socially oriented schooling.)

(5) I believe that "teaching" (that presumptive and arrogant word) will blend into learning and living.

(The act of "teaching" will occur whenever two or more persons enter voluntarily into an interpersonal encounter through mutuality of need, commonness of aspiration, with full awareness of reciprocal risks of failure or loss. The inducement to seek out such encounters originates from the promise of individual and mutual fulfillment as person relates to person in an authentic and shared regard for each other's being. There is indeed an important place for the guidance of the maturing adult in the life of the struggling youngster to develop and grow. But we must divest ourselves of the demeaning use of arbitrary authority supported often by mindless rules and sanctions that are autocratically imposed. Arbitrary authority is antithetical to the shaping of the socially responsible person in that "failure" on the part of the learner will not only lead to frustration and momentary helplessness but is also likely to contribute to excessive dependence and resentment.)

The Learner and Collective "Intelligence"

(1) I believe that the collective intelligence of the human race, as embodied in the surrounding culture, will become an awesome burden to comprehend but, at the same time, will be imbued with exciting opportunities for the learner to grow into an authentic person.

(The learner will have unusual and vital opportunities to confront the world as it is, as it was, and as it could be, a perspective that will serve to energize continually thought and action. The occasion for continued learning will be precipitated by the richness, the excitement, and even the anxiety to be different -- possibilities which are consonant with a culture in dissonance, harboring conflicting value systems, holding forth competing world views, and struggling with diverse modes of thought.[91, 92, 93, 94])

(2) I believe that the evolving technologies of communication, of stored intelligence, and creative expression, will serve to bring into realization capabilities for thoughtful reflection, legitimate action,

and scintillating play unimagined and unimaginable by the educator of the 1970's.

(The inherent power of the evolving technologies of communication and information systems will bring to realization "real time education" such as to enable any learner-person to make immediate adjustments in the form of new skill or intelligence in the face of complex and difficult problems. Such a prospect should diminish our fear in overlooking "important knowledge" that happens to have a bearing on a particular occasion of a person's future life.)

(3) I believe that the various instructional technologies, when engineered into a coherent system of influence, will bring to bear their unique powers of representation such as to revitalize and reactivate the temporarily desensitized and prematurely encapsulated learner.

(Media, particularly those in visual format, will be available to generate wonder and awe, puzzle and fascination and pathos and ecstasy in the life of the growing youngster. Displays, artifacts, experimental demonstrations, and puzzles, particularly as these are made available in learner-controlled exhibits will attract even the most lethargic of learners. "Walking through" a heart with the beating sound in one's ears, observing dramatic historic events of current and previous time on documentary color motion picture, witnessing a live demonstration with telephone commentary, observing the random fall of bouncing steel balls as they take the shape of the normal probability curve, entering into the problems of growing up through simulated discovery and motion picture and televized representation -- all such living encounters will be available within a few moments walking distance, the press of a button, or the flip of a switch, to enlarge the depth and expand the reach of vital human encounters.)

(4) I believe that the person of the learner will enter fully into the lives of others and be enabled to share their hopes and aspirations, their struggles and disappointments, and, in a deeply moving way, their joys and pains.

(The technologies of communication and instruction have already demonstrated their capability for projecting the learner into those moments of triumph and despair -- anyone who has seen such films as The War Game and World Without End would fully attest to the validity of this claim. Hologrammatic reproductions -- a synthetic creation through color, shape, sound, and movement in a three-dimensional, enveloping environment, will permit the learner, not only to see but to feel and virtually to touch. The allocation of "stored intelligence" and the burden of performing

routine functions in solving problems will free the human brain from the rigidifying effects of drill and the mundane memorization of discrete particulars. Rather, powers of intellect and imagination will be given full depth in acts of creative invention and re-creative expression.)

Agreed, such pronouncements may be pure fantasy, that imaginative stirring of troubled souls. Yet, the intelligence and the technologies are here. All we need are courage, conviction and confidence. Perhaps the most critical of these is confidence -- in the genuineness of our commitments and capabilities as well as in the commitments and capabilities of others.*

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*Readers who may wish to pursue the problems, prospects and possibilities of the educational future in more detail can consult such references as the following: the papers of Anderson and Emig[95], Baker[96], and Downey and Wilson[97] and Dyck et al[98]; the recent book by Jones[99]; the visionary critique by Leonard[100] and two works of Rogers[101, 102] Charles Silberman's book, Crisis In The Classroom is due for publication this fall, a preview of which has been offered in a three-article series in the Atlantic Monthly, the last of which appeared in the August issue[103] Mention should also be made of the High School of the Future: A Memorial to Kimball Wiles[104], a mission proposal to the Human Resources Research Council[105] and ASCD's latest yearbook.[106]

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